

It is not necessary to give a complete bibliography of the work done on the subject of symbiosis. References to the more important articles can be found in the paper of A. Schneider.<sup>2</sup> The principal papers of B. Frank, who has no doubt done more than any other observer on this subject, can be found in the *Berichte der deutschen botanischen Gesellschaft*, 1890, 1891, and 1892.

*Wabash College, Crawfordsville, Ind.*

EXPLANATION OF PLATES XVI AND XVII.

Figs. 1, 2. Base of aerial and subterranean stems of *Corallorhiza innata* R. Br.

Figs. 3-9. From *Corallorhiza multiflora* Nutt.

Fig. 3. Base of aerial and subterranean stems. Fig. 4. Longisection of root-stock; *a*, old leaf not yet broken away; *b*, *c*, remains of leaves that have broken away; *d*, papilla with trichomes, *e*; *e*, axial bundle; *f*, large cells containing raphides.  $\times 480$ . Fig. 5. Cells of cortical tissue, with hyphæ, taken from the tip of the stem where they contain but few hyphæ; *a*, enlarged nucleus. Fig. 6. One of the rudimentary bundles of the stem; *a*, general bundle sheath; *b*, xylem; *c*, phloem; *d*, fundamental tissue.  $\times 750$ . Fig. 7. Remains of a leaf, *a*, with trichomes, *b*.  $\times 750$ . Fig. 8. Papilla, *a*, with trichomes, *b*.  $\times 750$ . Fig. 9. Transection of root-stock; *a*, papilla with trichomes; *b*, cell with raphides; *c*, general bundle sheath; *d*, collateral fibro-vascular bundle with an unusually regular arrangement.  $\times 480$ .

### George Vasey: a biographical sketch.

WM. M. CANBY AND J. N. ROSE.<sup>1</sup>

WITH PORTRAIT—PLATE XVIII.

On the first of April, 1872, Dr. George Vasey was appointed Botanist to the Department of Agriculture. For twenty-one years he continuously held this position with credit to himself as well as to the advantage and satisfaction of the government and of his botanical confreres. The life of one who could do this during this time of great botanical activity and advancement must present interesting points to all who are engaged in the study of botany; and it is to satisfy this interest that these notes are written.

<sup>2</sup>Bull. Torr. Bot. Club, XIX, 216.

<sup>1</sup>It is proper to state here that Dr. Vasey had requested Mr. Canby to prepare a sketch of his life and the Editors of the GAZETTE not knowing of this request asked me to gather together what data I could regarding his life. At Mr. Canby's suggestion this article is published jointly as it avoids much duplication. My relations with Dr. Vasey, while most intimate, only extend back to 1888, whereas Mr. Canby has enjoyed an acquaintanceship and correspondence of more than 30 years.—J. N. R.



It will surprise many to learn that George Vasey was not a native of this country. He was born near Scarborough, England, on the twenty-eighth of February, 1822. In 1823 his parents came to this country and settled at Oriskany, Oneida County, New York, not far from the birthplace of Asa Gray who was then a lad at school. He was the fourth of ten children; and his father, a steady, excellent man, probably did the best he could when he provided him schooling up to the age of twelve. He had been, however, a good scholar and by that time had advanced sufficiently to have acquired some knowledge of algebra and a good foundation in Latin. He now became employed in a store as clerk, in which occupation he continued for several years at Oriskany and the neighboring village of Pleasant Valley. When between twelve and thirteen, he became interested in the study of botany by means of Mrs. Lincoln's "Elements of Botany," a little book well known to the older botanists of the country. Not having the means to purchase this *he copied it entire*. This interest in botany, so early manifested, was throughout his whole life his one great passion. His first meeting with a fellow-botanist is best told in his own words. "I remember well that one day as I was standing in the doorway of the store, I saw a gentleman approaching who stooped down and plucked a flower from the sidewalk. Coming to where I stood he held up the plant and asked me if I knew the name of it. I replied, 'Yes, it is a buttercup.' 'Well,' said he, 'do you know its botanical name?' 'Yes,' I replied, 'it is *Ranunculus acris*.' This was probably more than he had expected. We entered the store and he talked with me to ascertain how much I knew of botany. This stranger was Dr. P. D. Knieskern, a German physician, a fine scholar, and one of the foremost botanists of that day. He invited me to visit him, which I frequently did and, as I had considerable leisure early in the morning, I soon began to collect and preserve specimens of the plants of the vicinity and finally made frequent trips with the Doctor until I became well acquainted with the flora of the region. Through him I was led into correspondence with Dr. John Torrey and Dr. Asa Gray. I became much interested in the genus *Carex* which was largely represented in Oneida County and collected extensively, furnishing specimens to Prof. Chester Dewey of Rochester, Dr. Torrey, and especially to Mr. John Carey, then of New York, who afterward prepared the article on the genus *Carex* for an early



edition of Dr. Gray's Manual. I should also add the name of Dr. H. P. Sartwell of Penn Yan, New York, with whom I made large exchanges. Ultimately my correspondents included also Mr. S. T. Olney of Rhode Island and Prof. Daniel C. Eaton of New Haven, Conn."

When twenty-one years of age, having already graduated at Oneida Institute, he decided to study medicine and for this purpose attended three courses of lectures at the Berkshire Medical Institute, at Pittsfield, Mass., from which he graduated in 1846. While doing this he was obliged to support himself by teaching school. It was during this time that he first made the personal acquaintance of Prof. Dewey, at that time the leading caricographer of the country. Immediately after graduation he spent a few weeks at the College of Physicians and Surgeons, in New York City. It was at this time that he had the advantage of personally knowing the two pre-eminent botanists of America, Doctors John Torrey and Asa Gray, and from this time they were his life-long friends. About Christmas of this year he married Miss Scott, of Oriskany, and settled at Dexter, New York, where he commenced the practice of his profession. In 1848 he removed with his wife and child to Illinois, where, at Elgin and Ringwood, he spent eighteen years of his professional life. Very early in 1866 his wife's feeble health compelled him to seek the milder climate of southern Illinois, where, however, she soon died, and he did not long remain. Throughout all these years, first in the rich botanical region of central New York, and afterward almost throughout the prairies of Illinois, he had continued the study of his favorite science, making those large and useful collections which have so enriched the older herbaria of our country, and extending his botanical correspondence until it included all the active workers in the science. From the late Dr. Engelmann, especially, he received much aid, and he also came in pleasant contact with a number of active young botanists, among whom were the excellent Mr. Bebb, Major J. W. Powell, now head of the U. S. Geological Survey, Mr. H. N. Patterson and Mr. S. A. Forbes. These gentlemen, with others, such especially as Dr. J. A. Sewall and Prof. C. D. Wilber, were instrumental with him in forming the Illinois Natural History Society, of which Dr. Vasey was made President.

Toward the close of 1867 he was again happily married. His second wife was the widow of surgeon John W. Cameron.



and daughter of Dr. Isaac Barber, of New York. Soon after he met with a crushing financial disaster, largely dependent upon an imperfect title to his property. It was just at this time that Major Powell was organizing his Colorado Expedition for 1868, and he desired to have Dr. Vasey accompany him as botanist. The devotion of Mrs. Vasey, who took entire charge of his young family and of his entangled financial affairs, enabled him to accept this tempting offer. The expedition did not get under way until June, 1868. By the third of July it had reached Cheyenne and he had already collected one hundred and fifty species. On the twenty-first he wrote enthusiastically of his prospects and of the country, speaking of Denver as a "marvel of a place," having "a population of five or six thousand and many good brick business houses!" He returned in December with a splendid collection which has enriched and enlarged several of the best herbaria of the country. He had now wholly given himself up to botanical pursuits. For a year he was associated with Professor Riley in the editorship of the "Entomologist and Botanist," published at St. Louis, and was also curator of the Natural History Museum in the State Normal University of Illinois, which position he resigned to become the Botanist of the Department of Agriculture and Curator of the U. S. National Herbarium, under the Smithsonian Institution. He received this appointment on the recommendation of Dr. Gray and Prof. Henry. When he assumed these duties, the Herbarium, while containing most valuable material, was in poor condition and of little use. Under Dr. Vasey's wise and energetic administration it has become of vast extent and of prime importance. Overcoming by patient effort the lack of appreciation of those in high office who thought it a waste of time and money to advance the sciences which wait upon and promote true agriculture, he finally obtained adequate means to make his division one of the most active and useful in the Department. His first work of general interest was the collection of the woods of American forest-trees made for the Centennial Exposition in Philadelphia. It was only after much solicitation and some difficulty that he obtained a small appropriation for this purpose. This collection contained good specimens of most of the woods of our country, each specimen being accompanied by one or more herbarium sheets, showing flowers, fruits and leaves. It was a valuable



and instructive exhibit and paved the way for a better study and increased knowledge of the forest wealth, with which our country has been so richly blessed and which our people have so wantonly wasted.

But his crowning work was undoubtedly the building up of the great herbarium. In it are preserved the specimens collected in the various government surveys, and to these are added a vast number obtained by exchange and purchase, by gift from foreign governments and by collections from the remoter regions of the United States and Mexico made by the special collectors of the division. The collection of grasses from North America is probably the richest to be found anywhere. Of these alone there are nearly 15,000 sheets. A great part of these he not only named but labelled and mounted; and it is in the study of the Gramineæ as represented in North America that he has done peculiar service to American botany. It will perhaps be a surprise to many to know that before he took up the grasses as a specialty he had collected and studied mosses extensively. Of late years, however, he devoted all his spare time to the Gramineæ.

The result has been that his writings have been most largely upon grasses and forage plants. His most important paper in an agricultural point of view is probably the special bulletin on the agricultural grasses of the United States, published in 1884. This edition was soon exhausted and in 1889 a new, revised, and enlarged edition was published and has been in great demand. He published several other bulletins treating of grasses from a practical standpoint, those especially important being numbers 1, 3 and 6, of the Botanical Division. He contributed numerous scientific papers on grasses to botanical journals. In 1891, at the earnest solicitation of many correspondents as well as to carry out a long cherished wish of his own, he began the preparation of a monograph of North American grasses. This was prepared amidst the pressure of many official duties and perhaps was somewhat hastily published. The first part was issued February 25, 1892, and the second was being rapidly pushed but was not finished at the time of his death. The work, however, is so advanced that we may hope for its early completion and publication. But larger and more important than this was his *Illustrations of North American Grasses*. The first volume, issued in two parts, treats of the "Grasses of the



Southwest," and the second volume of the "Grasses of the Pacific Slope." The second part of the latter is still in press. A few months before his death, Dr. Vasey began to describe the new but unpublished grasses which had been accumulating in the herbarium for many years. This work was completed less than a week before he died.

In the year 1888 Dr. Vasey succeeded in bringing to the attention of Congress his long cherished scheme of establishing grass experimental stations in the arid and semi-arid regions of the west. With the assistance of the late Senator Plumb and others, an annual appropriation of \$40,000 was obtained for the Botanical Division. This allowed for considerable increase in the scientific force at the herbarium and the sending out of botanical expeditions. The chief object of this appropriation, however, was the establishment of the Grass Experimental Station at Garden City, Kansas. This work has been directly under the charge of Dr. J. A. Sewall. It was Dr. Vasey's idea to experiment here with both native and introduced species for the purpose of obtaining grasses and forage plants adapted to the region west of the 100th meridian where irrigation is not practicable. These experiments have all been made without irrigation and the result of the four years work has justified the outlay in money and has confirmed the wisdom of Dr. Vasey's plan.

Dr. Vasey's name has been twice used in forming generic names; first for a grass named *Vaseya* by Prof. Thurber. This, however, was properly merged in *Muhlenbergia*. Recently, Prof. Cogniaux has named a Cucurbitaceous plant *Vaseyanthus*. Many species also bear his name.

In 1864, Dr. Vasey received the degree of M. A. from the Ill. Wesleyan University. He was a member of the Geographical Society of Washington and a charter member of the Biological Society of the same city. Long a member, in 1889 he was made a fellow of the American Association for the Advancement of Science. He was made an associate fellow of the American Academy of Arts and Sciences on June 15, 1892. He was the joint representative of the Smithsonian Institution and the Agricultural Department to the Botanical Congress at Genoa in 1892, at which he was made one of the Vice-Presidents.

Dr. Vasey was a quiet and dignified gentleman of most kindly feeling and pleasing address. Those connected with him in his work speak with warmth of the pleasant relations



he sustained with them. While conscientiously efficient and firm in his duties, his sweetness of disposition made him beloved by all. To the narrowing circle of the older botanists who have so long known him and cherished his friendship, his loss comes with peculiar force. Few of the American botanists now living have been in touch with a larger circle of friends and correspondents; and some of these have been and always will be pre-eminent in the science.

Dr. Vasey died at Washington on March 4, 1893, after a severe illness of only three days. He leaves a widow and six children.

The following resolutions were passed by the officers of the National Museum at a meeting held on March 6th:

In the death of Dr. George Vasey the National Museum has lost a faithful and efficient officer, and the science of botany an able and indefatigable worker. As botanist of the Department of Agriculture and curator of the National Herbarium for twenty-one years, Dr. Vasey's name has become known to all botanists throughout the world and his contributions to science form an indispensable part of the working library of every botanist. His familiarity with the flora of all parts of the United States, especially with the plants of the great west, was unrivaled and caused his opinion to be sought and respected upon all critical questions relating thereto. He was the recognized authority on this side of the Atlantic in the important department of grasses, and his publications relating to these have great economic as well as scientific value.

Dr. Vasey was uniformly gentle and kind, manifesting a warm interest in the progress of younger botanists and beginners, always ready to give his valuable time and counsels to those who went to him for assistance, and many who are now well known in the science owe their success in large part to the encouragement and stimulation received from him. In this way the circle of his influence was much wider than would be naturally inferred from his quiet life and long confinement to a single post of duty.

To the world at large Dr. Vasey was distinguished for his modest and unobtrusive character, his kindly disposition, and his genial manners. A model husband and father, an estimable neighbor and a good citizen, his loss will be deeply felt by all who knew him. Therefore,

*Resolved,* That the sympathies of the officers of the National Museum and Smithsonian Institution be extended to the widow and family of the deceased and that a copy of this minute and resolution be transmitted to them.

Similar resolutions were passed by the scientific corps of the Department of Agriculture.

The following bibliography was prepared by Miss Josephine A. Clark, of the Botanical Division, Department of Agriculture.

#### 1870.

Spring flowers. Amer. Entomol. & Bot. II. 183-184.

The soft maples. Amer. Entomol. & Bot. II. 184-186.

Who should study botany. Amer. Entomol. & Bot. II. 186.

Blood-root. (*Sanguinaria Canadensis*.) Amer. Entomol. & Bot. II. 187.

Red-bud. (*Cercis Canadensis*.) Amer. Entomol. & Bot. II. 187-188.



- The grasses. Amer. Entomol. & Bot. II. 188-189.
- Editorial jottings. (Plants of southern Illinois.) Amer. Entomol. & Bot. II. 191.
- The common Virgin's Bower. (*Clematis Virginiana* L.) Amer. Entomol. & Bot. II. 216.
- The herbarium. Amer. Entomol. & Bot. II. 215-216.
- Pulsatilla. Amer. Entomol. & Bot. II. 216-217.
- How to study the grasses. Amer. Entomol. & Bot. II. 219-220.
- The flowering Dogwood. Amer. Entomol. & Bot. II. 221.
- Our cultivated grasses. Amer. Entomol. & Bot. II. 222.
- The Honey Locust. (*Gleditschia triacanthos* L.) Amer. Entomol. & Bot. II. 222-223.
- The woody Compositæ. Amer. Entomol. & Bot. II. 223.
- The oaks. Amer. Entomol. & Bot. II. 249-250.
- The rose. Amer. Entomol. & Bot. II. 254.
- Origin of prairie vegetation. Amer. Entomol. & Bot. II. 277.
- The oaks. Amer. Entomol. & Bot. II. 280-282.
- Botanical miscellany - Classification of the oaks. Amer. Entomol. & Bot. II. 282-283.
- The American Holly. (*Ilex opaca*.) Amer. Entomol. & Bot. II. 283-284.
- New plants.—*Saxifraga Forbesii*. Amer. Entomol. & Bot. II. 288.
- Foxglove Pentstemon. (*Pentstemon digitalis* Nutt.) Amer. Entomol. & Bot. II. 310.
- Our native oaks. Amer. Entomol. & Bot. II. 311-313, 375-377.
- Arborescent grasses. Amer. Entomol. & Bot. II. 377.

## 1874.

- Report of the botanist. (In U. S. Dept. of Agric. Rep. of the Commis. of Agric. for 1872. pp. 159-179. Washington, 1874.)

## 1875.

- Report of the botanist. (In U. S. Dept. of Agric. Rep. of the Commis. of Agric. for 1874. pp. 156-160. Washington, 1875.)
- Botanical notes [on common plants]. *Field & Forest* I. 5-6.
- Exotic trees in Washington. *Field & Forest* I. 17-19.
- Rare and noteworthy trees in Washington. *Field & Forest* I. 33-37.

## 1876.

- Forest-trees of the United States. Centennial collection. (In U. S. Dept. of Agric. Rep. of Comm. for 1875. pp. 151-186. Washington, 1876.) Reprinted. *Flora Columbiana; or, Catalogue of plants growing without cultivation in the District of Columbia and its immediate vicinity.* pp. 30 + [1]. 8°. Washington, 1876.
- Carices in Washington, D. C. *Bot. Gaz.* I. 37.
- Notes on *Festuca Thurberi*. *Bot. Gaz.* II. 53.



**1877.**

Some Oregon Gramineæ. *Bot. Gaz.* II. 126.

Report of the botanist. (In Dept. of Agric. Report of the Comm. for 1876. pp. 73-74. Washington, 1877.)

Botany at the Centennial. *Field and Forest* II. 142-144.

**1878.**

Gramineæ. (In U. S. War Dept. Rep. U. S. geol. surv. G. M. Wheeler in charge, VI. 281-297. Washington, 1878.)

*Poa Lemmoni* n. sp. *Bot. Gaz.* III. 13.

Additions to and corrections of the Catalogue of forest-trees of the United States. *Bot. Gaz.* III. 97-98.

**1879.**

*Panicum littorale* n. sp. *Bot. Gaz.* IV. 106.

Vasey, Geo., and Collier, Peter. Report of the botanist and chemist on grasses and forage plants. (In U. S. Dept. of Agric. Rep. of Comm. for 1878. pp. 157-194. Washington, 1879.)

**1880.**

Report of the botanist on grasses. (In U. S. Dept. of Agric. Rep. of Comm. for 1879. pp. 349-359. Washington, 1880.)

**1881.**

*Trichostema Parishii* Vasey. *Bot. Gaz.* VI. 173.

*Calamagrostis Howellii* n. sp. *Bot. Gaz.* VI. 271.

*Alopecurus saccatus* n. sp. *Bot. Gaz.* VI. 290.

Some new grasses—*Melica Hallii*, *Sporobolus Jonesii*, *Poa purpurascens*. *Bot. Gaz.* VI. 296-298.

Report of the botanist. (In U. S. Dept. of Agric. Rep. of Comm. for 1880. pp. 375-386. Washington, 1881.)

**1882.**

Some new grasses—*Poa pulchella*, *P. Bolanderi*, *Stipa Parishii*. *Bot. Gaz.* VII. 32-33.

Notes on N. American grasses, based on Mr. Benthham's recent paper on Gramineæ. *Amer. Nat.* XVI. 322.

Some new grasses—*Muhlenbergia setifolia*, *M. glomerata* var. *brevifolia* M. *sylvatica* var. *Californica*. *Bot. Gaz.* VII. 92-93.

The coniferous trees of the United States and Canada. *Montreal Herald* Sept. 5, 1882. Reprinted in *Amer. Journ. For.* I.

Report of the botanist. (In Dept. of Agric. Rep. of the Comm. for 1881. pp. 231-255. Washington, 1882.)

**1883.**

New western grasses. [A list of 29 names.] 1 page. Washington, 1883.

New species of grasses—*Agrostis tenuis*, *A. humilis*. *Bull. Torr. Club* X. 21.

On three hybrid oaks near Washington, D. C. *Bull. Torr. Club* X. 25-26.



- Note on *Cyperus refractus*, Eng. Bull. Torr. Club, x. 32.  
 Two new species of grasses—*Stipa stricta*, *Aristida Palmeri*. Bull. Torr. Club, x. 42-43.  
 New species of grasses—*Sporobolus Wolfii*, *Danthonia intermedia*. Bull. Torr. Club, x. 52.  
 The grasses of the United States. Bot. Gaz. VIII. 319.  
 New species of grasses—*Agropyrum Scribneri*, *Sporobolus Buckleyi*. Bull. Torr. Club, x. 128-129.  
 Report of the botanist—Grasses of the Great Plains. (In the U. S. Dept. of Agric. Rep. of the Comm. for 1883. pp. 83-98. Washington, 1883.)

## 1884.

- Agricultural grasses of the United States. pp. 144, 8°. Washington, 1884.  
 A new grass—*Ammophila Curtissii*. Bull. Torr. Club, XI. 7.  
 Schedule of North American species of *Paspalum*. Bot. Gaz. IX. 54-56.  
 A new species of grass—*Cathestechum erectum*. Bull. Torr. Club, XI. 37-38.  
 A new *Aristida*—*Aristida basiramea*. Bot. Gaz. IX. 76-77.  
 Notes on *Eriochloa*. Bot. Gaz. IX. 96-97.  
 New species of grasses—*Panicum Chapmani*, *P. Hallii*. Bull. Torr. Club, XI. 61-62.  
 A hybrid grass. Bot. Gaz. IX. 165-167.  
 New grasses—*Stipa Scribneri*, *Festuca confinis*, *Elymus Saundersii*. Bull. Torr. Club, XI. 125-126.  
 Vasey, Geo. and Scribner, F. L. A new *Eriochloa*—*Eriochloa Lemmoni*. Bot. Gaz. IX. 185.  
 Report of the botanist. (In U. S. Dept. of Agric. Rep. of the Comm. for 1884. pp. 123-136. Washington, 1884.)

## 1885.

- A descriptive catalogue of the grasses of the United States. pp. 110. 8°. Washington, 1885.  
 New grasses—*Trisetum Ludovicianum*, *Leptochloa Langloisii*, *L. Nealleyi*. Bull. Torr. Club, XII. 6-7.  
 Some new grasses—*Bromus Suksdorfii*, *B. Orcuttianus*, *Deyeuxia Cusickii*, *Deschampsia gracilis*. Bot. Gaz. X. 223-224.  
 Some new grasses—*Elymus Orcuttianus*, *Agropyrum tenerum*, *A. glaucum* R. & S. Bot. Gaz. X. 258-259.  
 A new grass—*Deyeuxia Macouniana*. Bot. Gaz. X. 297.  
 Plants of the Greely Expedition. Bot. Gaz. X. 364-366.  
 Report of the botanist. (In U. S. Dept. of Agric. Rep. of the Comm. for 1885. pp. 63-88. Washington, 1885.)

## 1886.

- Report of an investigation of the grasses of the arid districts of Kansas, Nebraska, and Colorado. pp. 18. 8°. Washington, 1886. (U. S. Dept. of Agric. Bot. Div. Bull. I.)  
 New American grasses—*Eriochloa mollis* var. *longifolia*, *Panicum Nealleyi*,



*P. repens* var. *confertum*, *P. virgatum* var. *macranthum*, var. *confertum*, var. *elongatum*, var. *diffusum*, *Imperata brevifolia*, *Aristida Arizona*, *A. Havardii*, *A. Orcuttiana*, *A. Schiediana* var. *minor*. Bull. Torr. Club, XIII. 25-28.

Tuberiferous *Hydrocotyle Americana*. Bull. Torr. Club, XIII. 28-29.

New American grasses—*Aristida Reverchonii*, *Stipa Lettermani*, *Muhlenbergia Parishii*, *M. Californica*, *M. Wrightii*, *Agrostis depressa*, *A. exarata* var. *stolonifera*, var. *littoralis*, *A. foliosa*, *A. Diegoensis*, *A. Oregonensis*, *Deyeuxia Cusickii*. Bull. Torr. Club, XIII. 52-56.

Notes on *Eatonia*. Bot. Gaz. XI. 116-117.

Gramineæ. (In Watson, S. List of plants collected by Dr. Edw. Palmer in southwestern Chihuahua, Mexico, in 1885. Proc. Amer. Acad. XXI. 442-444.)

National herbarium at Washington. Bot. Gaz. XI. 153-156.

New grasses—*Trisetum montanum*, *Diplachne Reverchoni*, *Glyceria Lemmoni*, *Festuca Texana*, *Elymus Macounii*, *E. nitidus*. Bull. Torr. Club, XIII. 118-120.

Synopsis of the genus *Paspalum*. Bull. Torr. Club, XIII. 162-168.

A new genus of grasses—*Orcuttia*. Bull. Torr. Club, XIII. 219; West Amer. Sci. III. 4-6.

New grasses—*Sporobolus Bolanderi*, *Agrostis attenuata*, *A. foliosa*, *Muhlenbergia Neo-Mexicana*, *M. acuminata*. Bot. Gaz. XI. 337-338.

New species of Mexican grasses collected by Dr. Edw. Palmer, in southwest Chihuahua, in 1885. Bull. Torr. Club, XIII. 229-232.

### 1887.

Desiderata of the herbarium for North America, north of Mexico; Ranunculaceæ to Rosaceæ, inclusive. pp. 15. 8°. Washington, 1887. (U. S. Dept. of Agric.—Bot. Div. Bull. 4.)

Grasses of the South; a report on certain grasses and forage plants for cultivation in the south and southwest. pp. 63. 8°. Washington, 1887. (U. S. Dept. of Agric.—Bot. Div. Bull. 3.)

New species of Mexican grasses—*Sporobolus Shepherdii*, *S. annuus*, *S. racemosus*. Bull. Torr. Club, XIV. 8-10.

[Review of] Grasses of North America, for farmers and students.—W. J. Beal. Vol. I. 1887. Bull. Torr. Club, XIV. 103-104.

New grasses—*Poa rupestris*, *Panicum Havardii*. Bull. Torr. Club, XIV. 94-95.

Special uses and properties of some Mexican grasses. Bull. Torr. Club, XIV. 98-100.

Gramineæ. (In Watson, S. List of plants collected by Dr. Edw. Palmer, in the state of Jalisco, Mexico, in 1886. Proc. Amer. Acad. XXII. 459-462.)

*Redfieldia*, a new genus of grasses. Bull. Torr. Club, XIV. 133-134.

Fasciation in *Sophora secundiflora*. Bot. Gaz. XII. 160-161.

The new California *Poa*—*Poa Orcuttiana*. West Amer. Sci. III. 165-166.

Botany at the Department of Agriculture. Bull. Torr. Club, XIV. 203-205.

[Review of] Grasses and forage plants. By Charles L. Flint. Bot. Gaz. XII. 301-302.

Notes on the Paspali of Le Conte's monograph. Proc. Acad. Phila., 1886. 284-285.



Report of the botanist. (In U. S. Dept. of Agric. Rep. of the Comm. 1886. pp. 69-93. Washington, 1887.)

### 1888.

New western grasses—*Poa macrantha*, *P. argentea* Howell, *Alopecurus Howellii*, *A. Macounii*, *A. geniculatus* var. *robustus*, *A. Californicus*. Bull. Torr. Club, xv. 11-13.

New or rare grasses—*Triodia Nealleyi*, *T. repens*, *Bouteloua stricta*, *Stipa flexuosa*, *Sporobolus Nealleyi*, *Poa Tracyi*, *Diplachne Tracyi*. Bull. Torr. Club, xv. 48-49.

Synopsis of the genus *Panicum* Linn. Bot. Gaz. XIII. 96-97.

Notes on Hackel's monograph of Gramineæ. Bull. Torr. Club, xv. 116-117.

Rules for the Botanical exchange club. Bot. Gaz. XIII. 160-161; Bull. Torr. Club, xv. 167-168.

The Exchange club. Bot. Gaz. XIII. 161-162.

Characteristic vegetation of the North American desert. Bot. Gaz. XIII. 258-265.

On two species of Gramineæ—*Sporobolus confusus*, *Melica Smithii*. Bull. Torr. Club, xv. 293-294.

Notes on some rare grasses—*Andropogon Hallii*, *Redfieldia flexuosa*. Bull. Torr. Club, xv. 294-295.

Description of *Alopecurus Stejnegeri*, a new species of grass from the Commander Islands. Proc. U. S. Nat. Mus. 1887. x. 153.

Grasses of the arid districts. pp. 61. 8°. Washington, 1888. (U. S. Dept. of Agric.—Bot. Div. Bull. 6.)

Report of the botanist. (In U. S. Dept. of Agric. Rep. of the Comm. for 1887. pp. 301-21. Washington, 1888.)

### 1889.

Gramineæ. (In Watson, S. Collection of plants made by Dr. Edw. Palmer, in 1887, about Guaymas, Mexico, at Muleje and Los Angeles Bay in Lower California, and on the Island of San Pedro Martin in the Gulf of California. Proc. Amer. Acad. XXIV. 79-81.)

The National Herbarium. Bot. Gaz. XIV. 158-159.

List of plants from Lower California sent to the Smithsonian Institution by Lieut. C. F. Pond, U. S. N. Proc. U. S. Nat. Mus. 1888. XI. 368.

New or little known plants—*Uniola Palmeri*. Gard. and For. II. 401.

Agricultural grasses and forage plants of the United States. Ed. 2, rev. & enl. pp. 148. 8°. Washington, 1889. (U. S. Dept. of Agric.—Bot. Div. Special Bulletin.)

Report of the botanist. (In U. S. Dept. of Agric. Rep. of the Comm. for 1888. pp. 305-324. Washington, 1889.)

Vasey, Geo., and Galloway, B. T. A record of some of the work of the [Botanical] Division including extracts from correspondence and other communications. pp. 67. 8°. Washington, 1889. (U. S. Dept. of Agric.—Bot. Div. Bull. 8.)

Vasey, Geo., and Rose, J. N. List of plants collected by Dr. Edw. Palmer, in Lower California, in 1889. Proc. U. S. Nat. Mus. 1888. XI. 527-536.



## 1890.

List of the plants collected in Alaska in 1888. Proc. Nat. Mus. 1889. XII. 217-218.

Cactus landscapes. Amer. Gard. xi. 468-470.

A new grass—*Rhachidospermum Mexicanum*. Bot. Gaz. xv. 106-110.

Gramineæ. (In Coulter, J. M. Collection of plants made by G. C. Nealley in the region of the Rio Grande, in Texas, from Brazos Santiago, to El Paso county. Contr. Nat. Herb. 1, no. 2. 52-61.)

Vasey, Geo., and Rose, J. N. (1) Plants collected by Dr. Edw. Palmer, in 1888, in southern California. (2) Plants collected by Dr. Edw. Palmer, in 1889, at Lagoon Head, Cedros Island, San Benito Island, Guadalupe Island, and Head of the Gulf of California. Contr. Nat. Herb. 1. 1-28.

Notes on *Melica* and *Poa*. Bull. Torr. Club, xvii. 178-179.

Illustrations of North American grasses. Grasses of the Southwest. 1. pt. 1. roy. 8°. pp. [50]. pl. 50. Washington, 1890. (U. S. Dept. of Agric.—Bot. Div. Bull. 12.)

The translation of Hackel's True grasses. Bot. Gaz. xv. 268-269.

Vasey, Geo., and Rose, J. N. List of plants collected by Dr. Edward Palmer, in 1890, in Lower California and western Mexico. Contr. Nat. Herb. 1. 63-90.

Report of the botanist. (In U. S. Dept. of Agric. Rep. of the Comm. for 1889. pp. 379-396. Washington, 1891.)

## 1891.

New grasses—*Sporobolus pilosus*, *Bouteloua uniflora*, *Andropogon macrourus* var. *pumilus*. Bot. Gaz. xvi. 26-27.

New grasses—*Orcuttia Greenei*, *Eragrostis spicata*, *Muhlenbergia Alamosa*, *Calamagrostis densus*, *C. kœlerioides*. Bot. Gaz. xvi. 145-147.

Gramineæ. (In Rose, J. N. Plants collected by Dr. Edw. Palmer, in 1890, in western Mexico and Arizona. Contr. Nat. Herb. 1. 114-115.)

A new grass—*Melica* (?) *multinervosa*. Bot. Gaz. xvi. 235-236.

A neglected *Spartina*—*Spartina junciformis* Engelm. & Gray. Bot. Gaz. xvi. 292.

Grasses of the Southwest. vol. 1. pt. 2. pp. (50) pl. 50. roy. 8°. Washington, 1891. (U. S. Dept. of Agric. Bot. Div. Bull. 12.)

Vasey, Geo. and Rose, J. N. Plants collected, in 1889, at Socorro and Chirion Islands, Pacific Ocean. Proc. U. S. Nat. Mus. 1890. XIII. 145-149.

Report of the botanist. (In Dept. of Agric. Rep. of the Sec'y for 1890. pp. 375-392. Washington, 1891.)

Report on the Dept. of botany in the U. S. National Museum 1889. (In Smithsonian Inst.—U. S. Nat. Mus. Rep. 1889. p. 399. Washington, 1891.)

Report on the Dept. of botany in the U. S. National Museum 1890. (In Smithsonian Inst.—U. S. Nat. Mus. Rep. 1890. pp. 237-239. Washington, 1891.)

## 1892.

Monograph of the grasses of the United States and British America. pt. 1. Contr. Nat. Herb. III. 1-89.



Grasses of the Pacific slope, including Alaska and the adjacent islands. pt. 1.<sup>1</sup> roy, 8°. pp. (50) pl. 50. Washington, 1892. (U. S. Dept. of Agric.—Bot. Div. Bull. 13.)

Report of the botanist<sup>2</sup>. (In U. S. Dept. of Agric. Rep. of the Sec'y for 1891. pp. 341-358. Washington, 1892.)

*Wilmington, Del. and Washington, D. C.*

### Frost freaks of the dittany.

BY LESTER F. WARD.

WITH PLATE XIX.

One bright, crisp, frosty morning (Dec. 5, 1892), as I was taking a delightful ramble with my congenial friend Mr. Victor Mason and following the pleasant road that leads from the little Virginia village of Accotink toward the tomb of Washington, some white objects looking like icicles close to the ground on our right along the border of a pine wood arrested our attention. After remarking a number without stopping to inspect them they presently grew so numerous and exhibited such a uniformity that the scientific instinct could no longer be restrained and we turned aside to satisfy our curiosity.

We found that they were in truth nothing but ice, but that instead of icicles they were veritable freaks of frost. Every one was firmly attached to the stem of a small herbaceous plant which had succumbed to the season but still stood erect. The attachment was always close to the base, often at the very ground, sometimes an inch above. At a distance the frost-works had the appearance of cylindrical masses, but one need not come very near to see that such was not the case. In fact they really consisted of several thin foils or wings from one to three inches in width, firmly attached by one edge to the stem of the plant, thus standing in a vertical position. From this attachment each of these little ice sheets projected out horizontally or with a slight upward tendency, not straight and stiff, but gently and gracefully curving or coiling into a beautiful conch-like roll at the distal margin. There were always several of these, usually three, four, or five, all attached

<sup>1</sup>Part 2 of this work will be issued June 1, 1893.—J. N. R.

<sup>2</sup>Report of the botanist for 1893 will be issued in June, 1893.—J. N. R.